Environmental and Health Impacts of Air Pollution: Ozone

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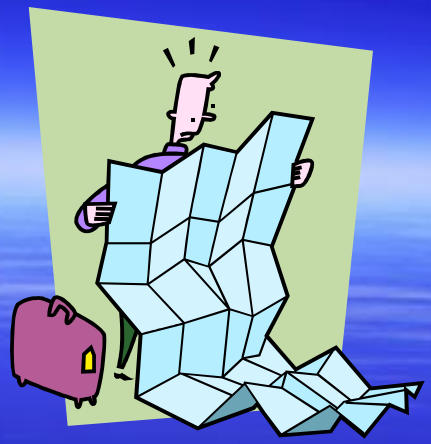
Road Map



- What is Ozone?
- Health Effects: Short Term & Long Term
- Environmental Effects
- Risk Groups
- Case Study: West Point Military Academy
- National Air Quality Standards for Ozone
- EPA Air Quality Index
- Taking Action

Ground Level Ozone

- What is typically referred to as “smog” is made up of ground level ozone
- VOCs + NOx + Sunlight = Ozone

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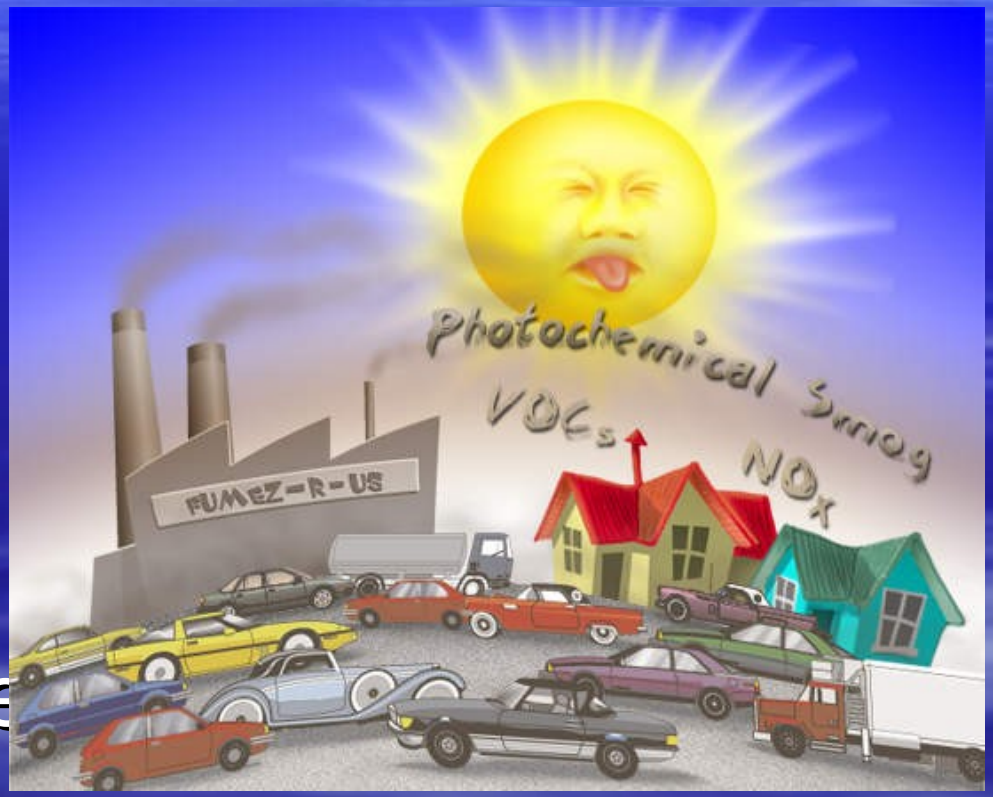


Volatile Organic Compounds

- Many compounds that are made of carbon, oxygen and hydrogen, evaporate easily and form gases

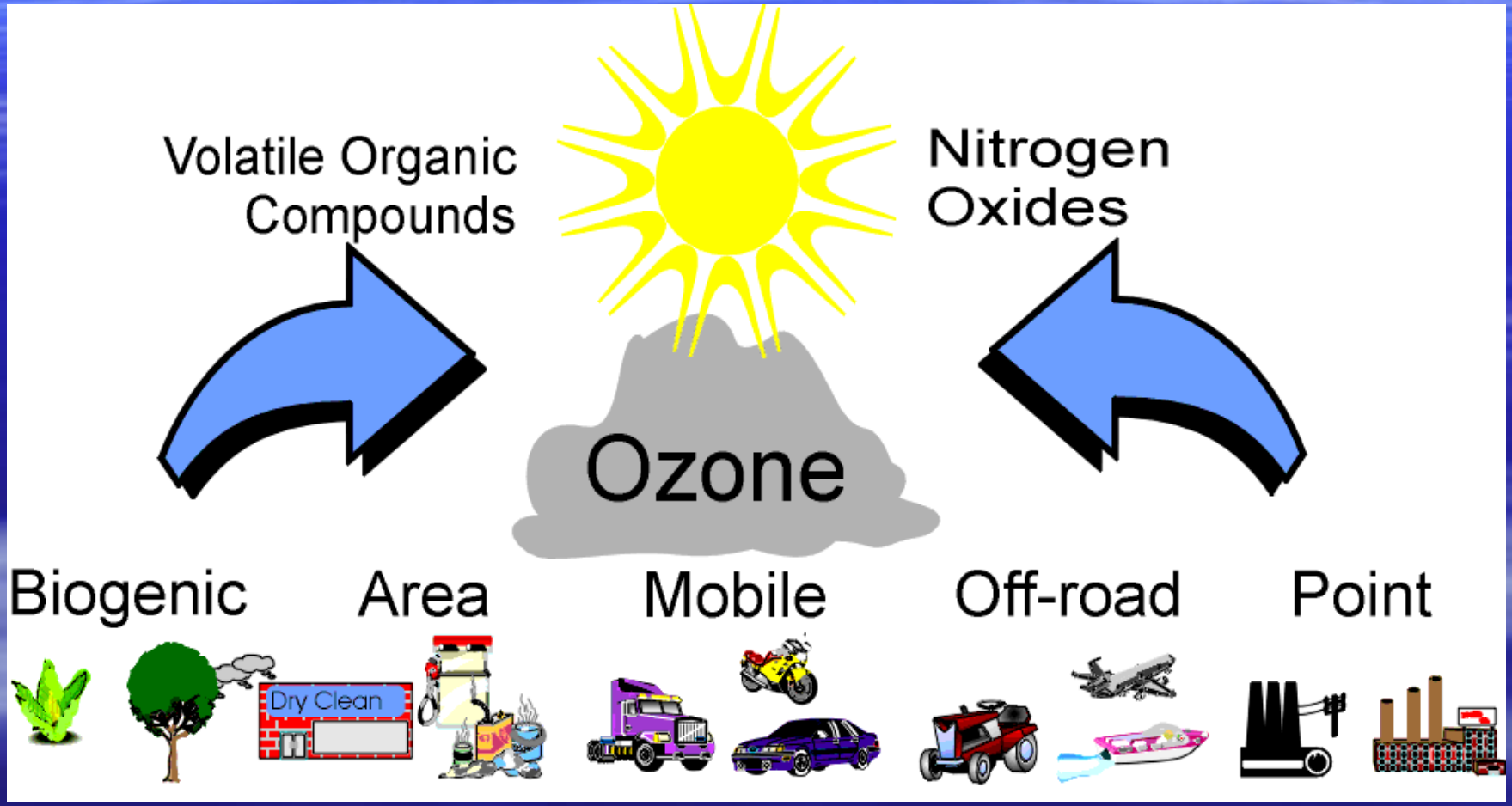
- Sources of VOCs include: gasoline, paint, solvents, pesticides and charcoal lighter fluid, vehicles and chemical plants

Nitrogen Oxides (NOx)

- Light brown gas made up of nitrogen & oxygen

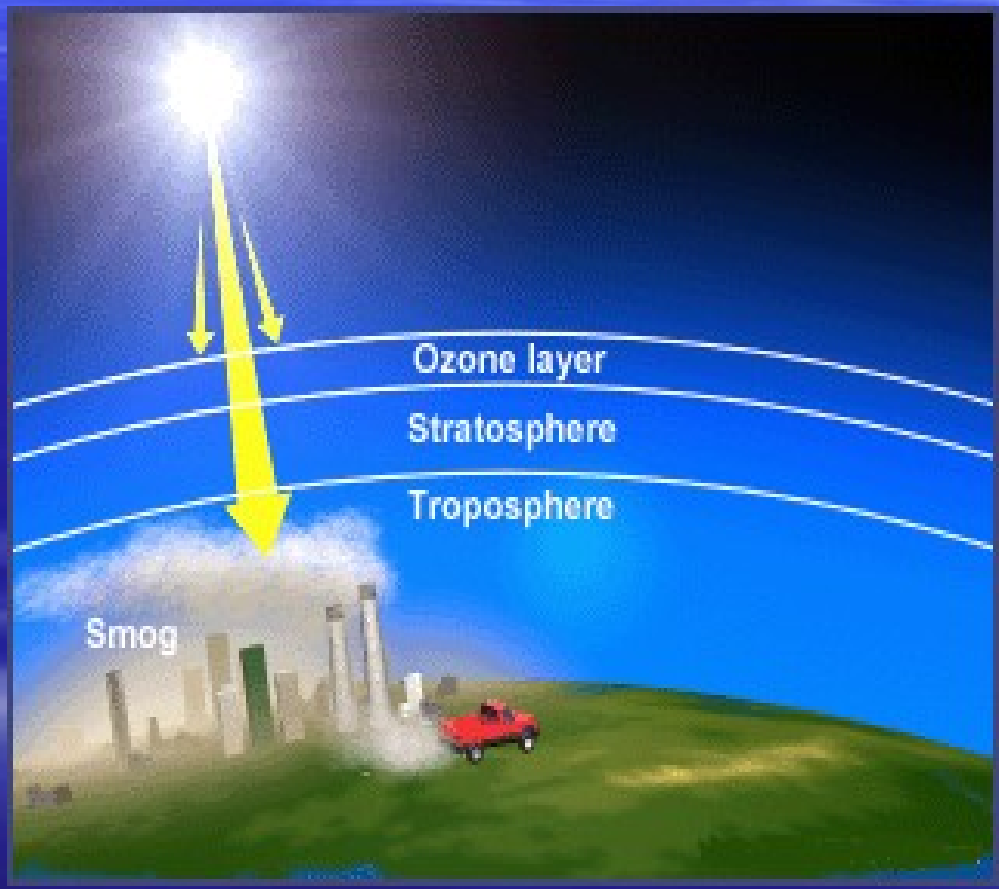
- Sources of NOx: motor vehicles, fossil fuel fired power plants, wood burning stoves

How Ground Level Ozone is Formed



Two Types of Ozone

- Good Ozone: Ozone in the stratosphere high above the earth protects human health and the environment
- Bad Ozone: Ground Level ozone is a respiratory irritant to human health



Health Effects- Short Term

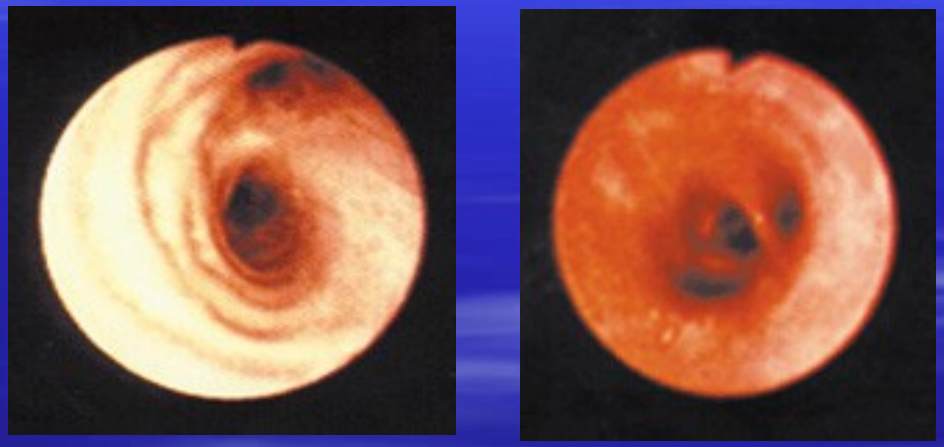
- Short Term Exposure: 1-6 hours/day
- Lung damage is typically reversible
- Symptoms include:
  - Reduced lung function (difficulty breathing)
  - Chest pain
  - Throat and eye irritation
  - Aggravated asthma
  - Increased asthma attacks
  - Increased sensitivity to allergens and pollutants

Health Effects: Long Term

- Long Term Exposure: 6+ hours/day
- Cumulative exposure causes permanent lung damage
- Symptoms include:
  - Reduced lung function
  - Inflammation of lung lining
  - Higher rate of developing asthma
  - Increased lung cancer mortality rates

Health Effects: Long Term cont.

- Lung tissue damage
  - "sunburn" to the lungs
- Permanent lung damage
  - Children: decreased lung function
  - Adults: premature aging of lungs



Ozone can inflame the lung's lining. A healthy lung air way (left) and an inflamed air way (right)

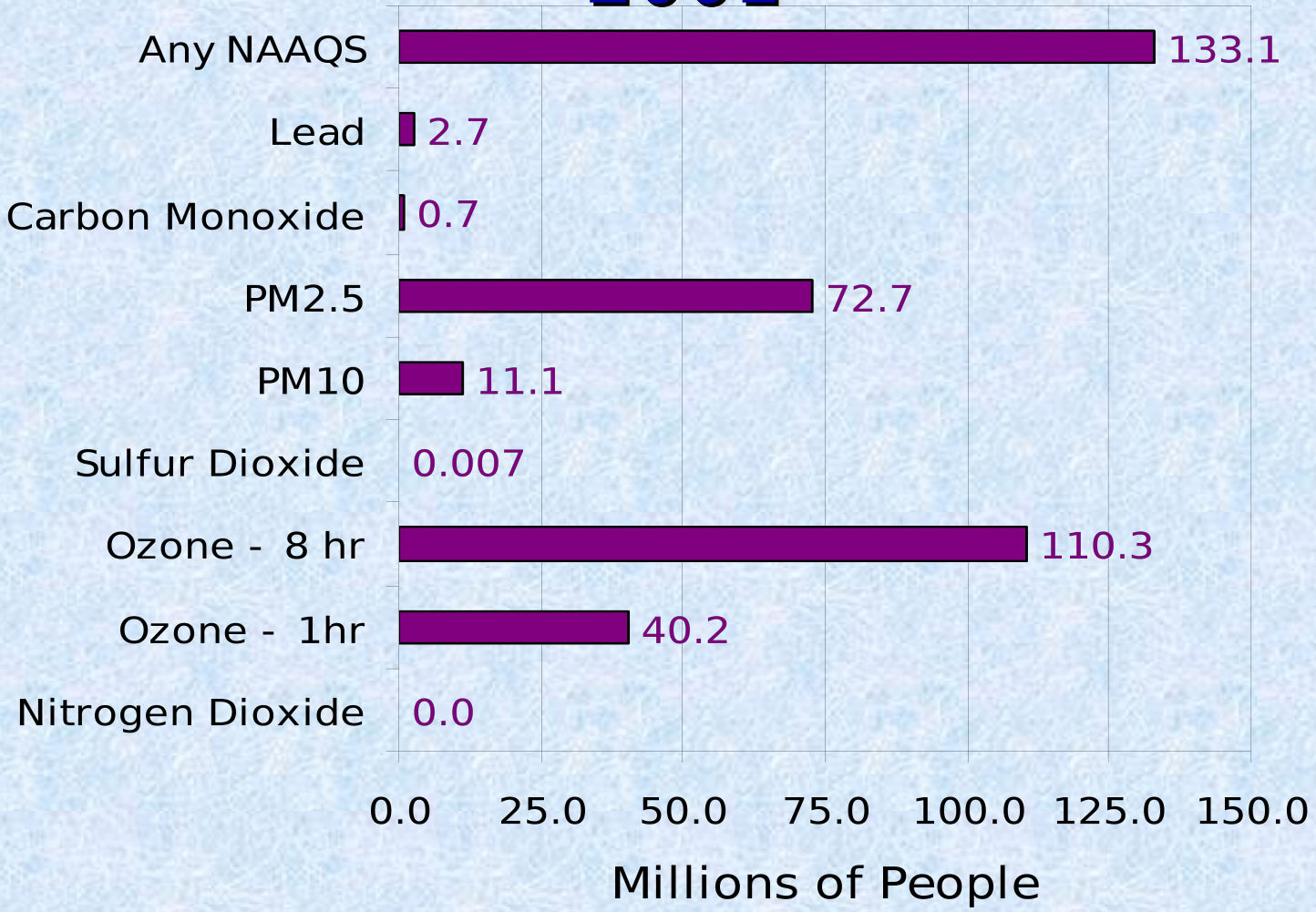
Environmental Effects of Ozone Pollution

- Damage to vegetation
- Degrades water quality
- Reduces visibility (haze)
- Affects quality of life

Who is at Risk?

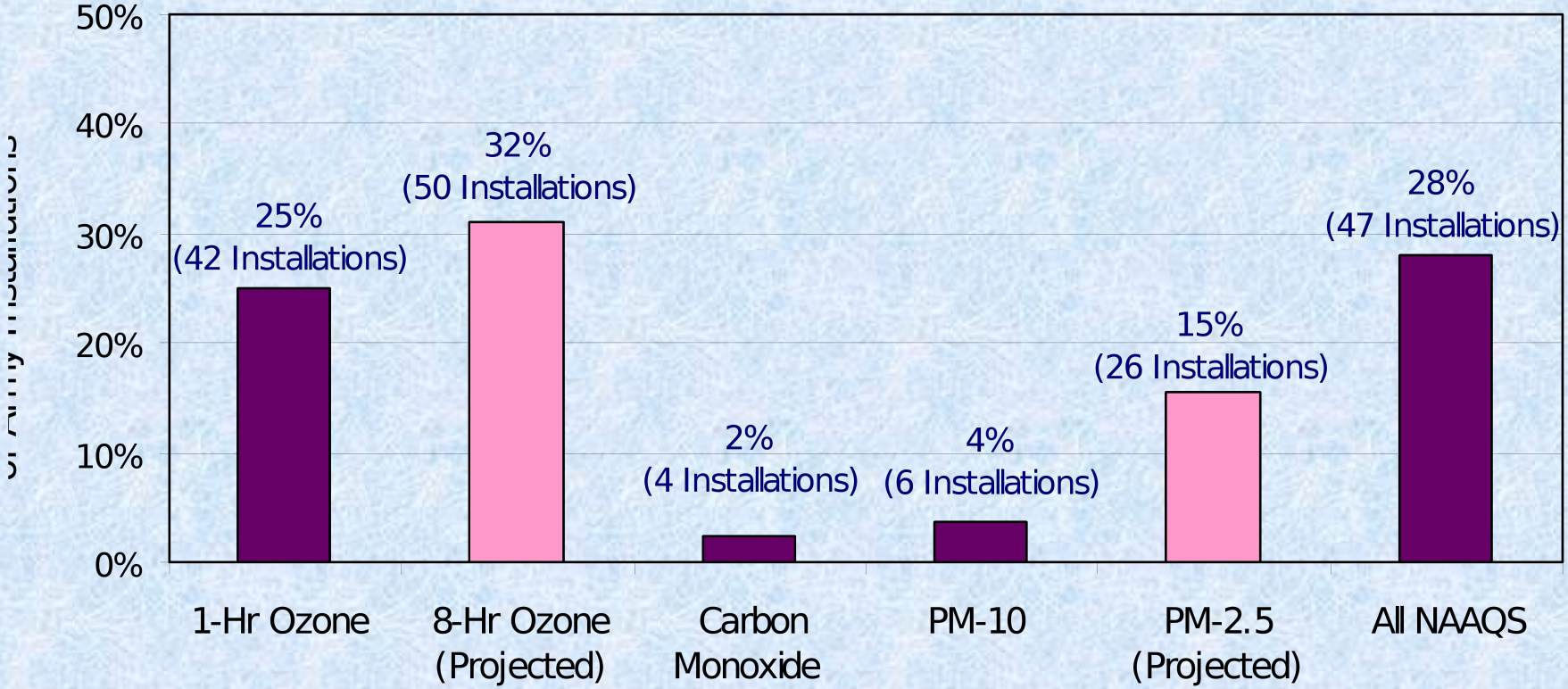
- Children
- People with pre-existing respiratory problems
- ***Healthy adults*** who are active outside (includes athletes)
- Some individuals are more susceptible to ozone exposure
- Senior citizens
- Pregnant women

People Living in Counties with Air Pollutant Levels that Exceed the NAAQS - 2001



Force Health Protection

U.S. Army Installations in Poor Air Quality Areas



*As of Feb 2003

Case Study: West Point

- Do lung function changes occur over a summer season among healthy adults working outdoors in the presence of ozone?
- 72 sophomore cadets (68 males, 4 females) participating in the Drill Cadet Leadership Training (DCLT)
- Ft. Dix, NJ (21); Ft. Benning, GA (29); Ft. Leonard Wood, MO (9); Ft. Sill, OK (13)
- Ozone monitored by state air quality monitoring sites nearby the installations

Respiratory Tests

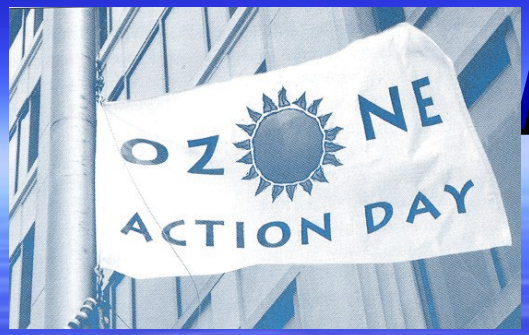
- Each cadet was tested for the following before and after the training:
- FVC: Forced Vital Capacity- Total volume of air expelled
- FEV_1: Volume of air expelled in one second
- FEV_{25-75}: Forced expiratory flow rat between 25-75% FVC

Test Data

- 88% were exposed (passively) to cigarette smoke (avg. 3.1 hrs/day)
- 64% were exposed to dust, exhaust or smoke (avg. 1.8 hrs/day)
- Average time spent outdoors: 11.3 hrs/day
- Conducted extensive training and exercise

Results

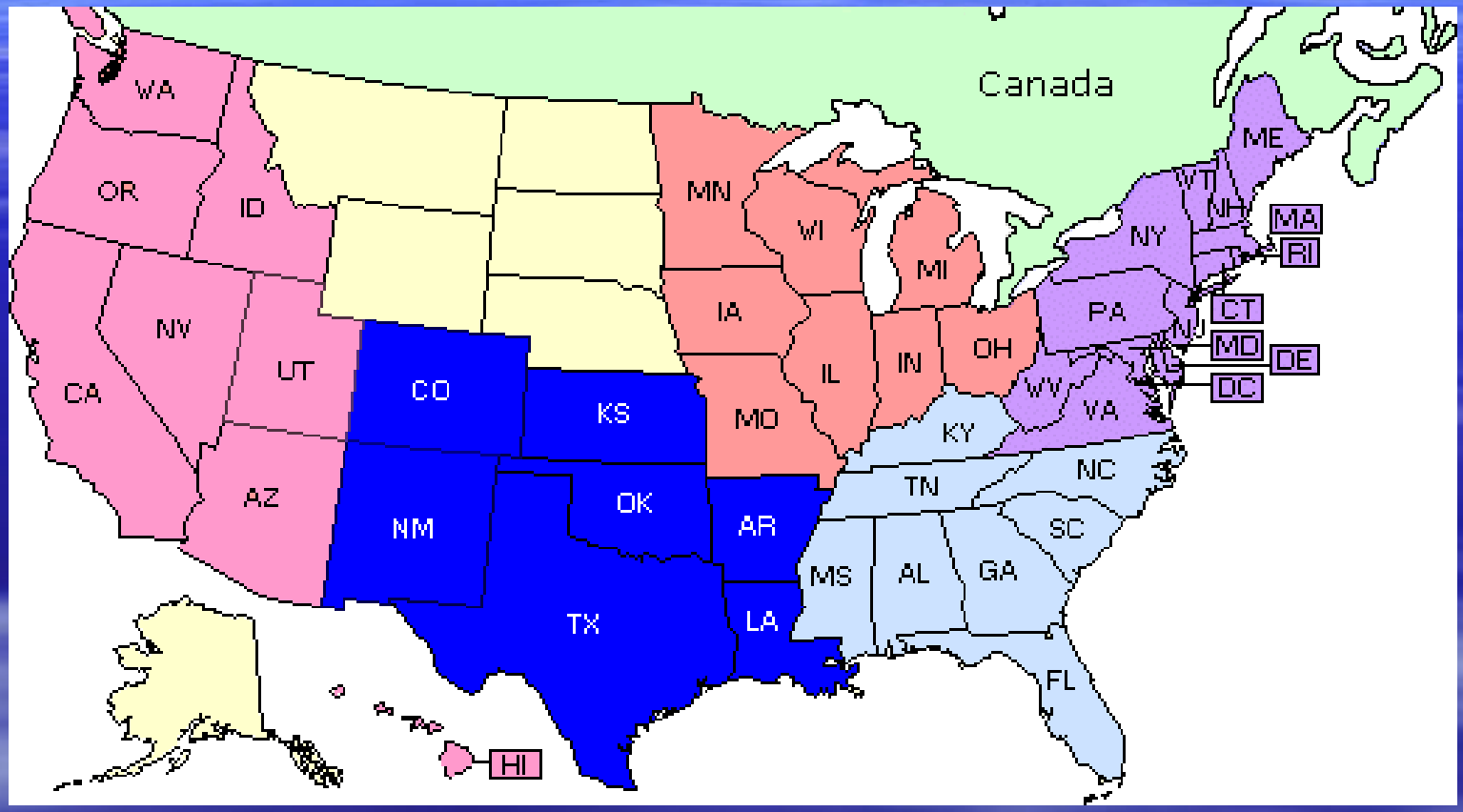
- Increase in number of symptoms reported (cough, wheezing, chest tightness, head cold etc) for all cadets at follow-up visit
- General decline in respiratory health for all cadets
- Peak ozone concentrations were above 100 ppb on a routine basis at Ft. Dix
- Cadets that attended Ft. Dix, NJ site had a larger drop in lung function over the summer than cadets at other training sites



What is Being Done?

- Additional states and counties are adding ozone monitors
- States are implementing Ozone Awareness Campaigns (check state websites)
- EPA AIRNow Website provides real-time ozone maps and forecasts for 44 states (see map)

AIRNow Ozone Coverage Map



*Areas in yellow are not currently monitored by EPA

Air Quality Standards

- Ozone standards (40 CFR Part 50)
  - 8-hour: 0.08 ppm
  - 1 hour: 0.12 ppm
- Represents primary and secondary standards
- Primary: protect human health and sensitive populations
- Secondary: protect public welfare (visibility, damage to crops, animals and buildings)

Air Quality Index (AQI)

- The AQI scale has been divided up into 5 categories each corresponding to a different level of health concern
- States with large metro areas are required to report the air quality on high ozone days
- AQI is a uniform scale used to report actual levels of ozone (and other pollutants) in the air. The higher the AQI value, the greater the health concern.
- Public can correlate air pollution and possible health effects through color coded system

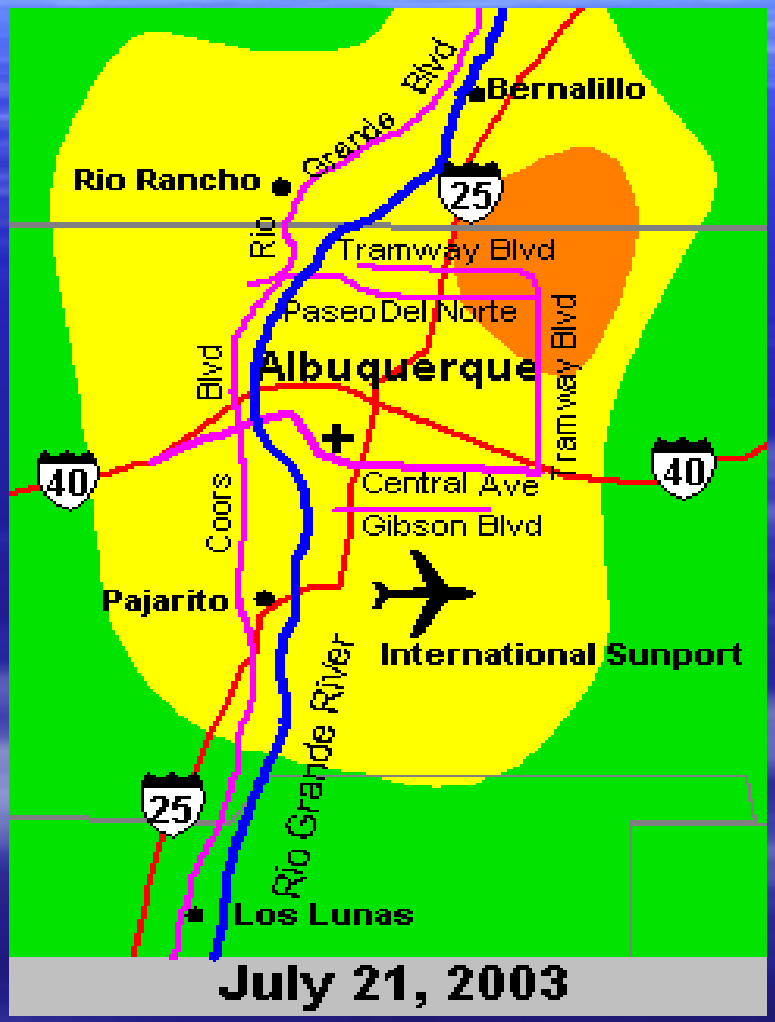
Air Quality Index

Index Values (ppm)	Levels of Health Concern	Cautionary Statements
0-50	Good	None
51-100	Moderate	Unusually sensitive people should consider limiting prolonged outdoor exertion.
101-150	Unhealthy for Sensitive Groups	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
151-200	Unhealthy	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion.
201-300	Very Unhealthy	Active children, adults & people with respiratory disease, (asthma), should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.
301-500	Hazardous	Everyone should avoid all outdoor exertion.

Ozone Forecast

Obtained from www..weather.com

Ozone Map for Albuquerque



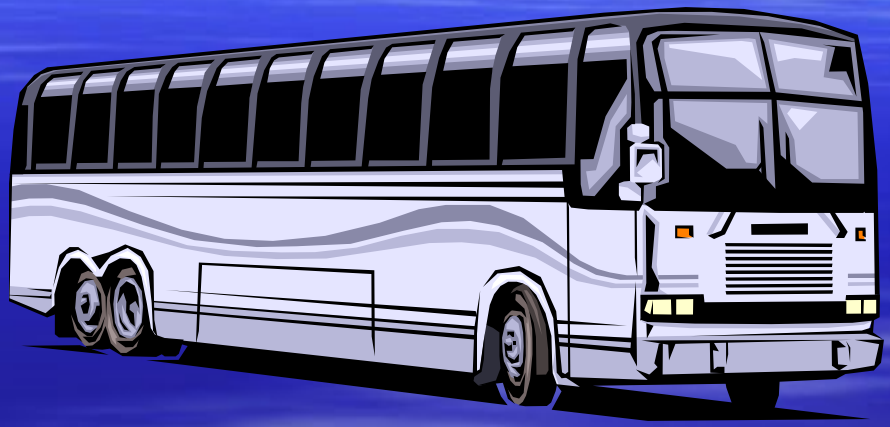
Obtained from AIRNow

High Ozone Day: Individual Actions

- Avoid exercising outdoors (1100-1800)
- Limit children's exposure (play indoors)
- Keep all vehicles maintained and tuned up
- Refuel boats and cars [illegible] after
- Avoid using gas-pow[illegible] equipment

Individual Actions cont.

- Use water-based paints, not oil-based
- Avoid aerosol products
- Take public transportation
- Avoid using charcoal grills and lighter fluid



Organizational Actions

- Curtail outdoor PT on high ozone days
- Ozone alerts to employees (bulletin boards/email)
- Close/reduce operations at on-post gasoline stations (including MWR)
- Postpone operations such as vehicle painting, smoke/obscurants testing and lawn maintenance
- Encourage telework and telecommute benefits
- Carpool, bring your lunch or take transit

Conclusions

- Ozone affects not only “sensitive” populations but also healthy active adults
- 38% of the nation’s population lives in areas that exceed ozone standards
- Individual actions can contribute to or decrease ozone levels in your area
- Monitor your respiratory health if outdoors for extended periods of time

Do Your Share for Cleaner Air